

single burst of the tactile feedback when the touch position or the detected pressure changes more than a preset threshold value

**[0017]** In another embodiment of the present invention, the GUI object may be formed with a plurality of sub-elements, and the haptic feedback generating unit may generate different tactile feedbacks for different sub-elements thereof.

**[0018]** In another embodiment of the present invention, the controller section may determine that the GUI object is in the activated state by using a plurality of pressure thresholds.

**[0019]** In another embodiment of the present invention, the controller section may differentiate a stronger push and a lighter push based on a noise level of a signal output from the touch screen or a circuitry thereof, the stronger push corresponding to the pressing event, the lighter push corresponding to sliding of the user's finger or pointing device.

**[0020]** In another embodiment of the present invention, the display section may generate visual feedback in correlation with the haptic feedback.

**[0021]** In another embodiment of the present invention, a graphical user interface method for a touch screen is provided. The method includes: displaying a graphical user interface object on the touch screen, the graphical user interface object having a plurality of logical states; detecting a touch position on the touch screen, at which a user's finger or a pointing device is touching; detecting pressure applied on the touch screen when the touch position is detected; and generating haptic feedback in response to the touching, a form of the haptic feedback being determined depending on (i) the detected touch position, (ii) the detected pressure value and (iii) a current logical state of the GUI object. The current logical state of the GUI object is determined by using a history of detected touch positions and a history of detected pressure values.

**[0022]** In the embodiments of the present invention, the form of the haptic feedback is determined depending on the touch position, the pressure applied by the user and the current logical state of the graphical user interface object. Accordingly, various forms of the haptic feedback may be provided for different logical states of the graphical user interface object, making it easy for the user to know the current state of the graphical user interface object.

#### ADVANTAGES OF THE INVENTION

**[0023]** The present invention makes it possible to provide tactile notification when a user touches a user interface element on a touch screen without executing functionality of the user interface element, and tactile notification to the user when the functionality of the user interface element is executed.

**[0024]** Furthermore, according to the present invention, a method of user interface utilizing a touch screen display device capable of providing tactile feedback and measuring pressure applied to the touch screen is provided. The method allows a user to have interactive operations similar to ones

with physical operation means. Further, according to the present invention, an apparatus that employs such a user interface method is provided.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0025]** A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

**[0026]** FIG. 1 is a block diagram showing an example of an apparatus configuration according to an embodiment of the present invention;

**[0027]** FIG. 2 is a schematic diagram showing an example of interaction with touch screens of prior art;

**[0028]** FIG. 3 is an explanatory illustration of a user interface method according to an embodiment of the present invention for a case where a user finger slides over a GUI object;

**[0029]** FIG. 4 is a flow chart showing steps of a user interface method according to an embodiment of the present invention;

**[0030]** FIG. 5(a) is an explanatory illustration of a user interface method according to another embodiment of the present invention for a case where a pressing event is recognized;

**[0031]** FIG. 5(b) is an explanatory illustration of a user interface method according to another embodiment of the present invention for a case where a pressing event is recognized;

**[0032]** FIG. 5(c) is an explanatory illustration of a user interface method according to another embodiment of the present invention for a case where a pressing event is recognized;

**[0033]** FIG. 6 is a flow chart showing steps of a user interface method according to another embodiment of the present invention;

**[0034]** FIG. 7(a) is a schematic diagram showing an example of hotspot in a GUI object;

**[0035]** FIG. 7(b) is a schematic diagram showing an example of hotspot in a GUI object;

**[0036]** FIG. 7(c) is a schematic diagram showing an example of hotspot in a GUI object;

**[0037]** FIG. 7(d) is a schematic diagram showing an example of hotspot in a GUI object;

**[0038]** FIG. 8 is a flow chart showing steps of a user interface method according to still another embodiment of the present invention;

**[0039]** FIG. 9 is a flow chart showing steps of a user interface method according to another embodiment of the present invention;

**[0040]** FIG. 10(a) is an explanatory illustration of a user interface method according to an embodiment of the present invention for a slider-type GUI object;

**[0041]** FIG. 10(b) is an explanatory illustration of a user interface method according to an embodiment of the present invention for a slider-type GUI object;

**[0042]** FIG. 10(c) is an explanatory illustration of a user interface method according to an embodiment of the present invention for a slider-type GUI object;

**[0043]** FIG. 10(d) is an explanatory illustration of a user interface method according to an embodiment of the present invention for a slider-type GUI object; and